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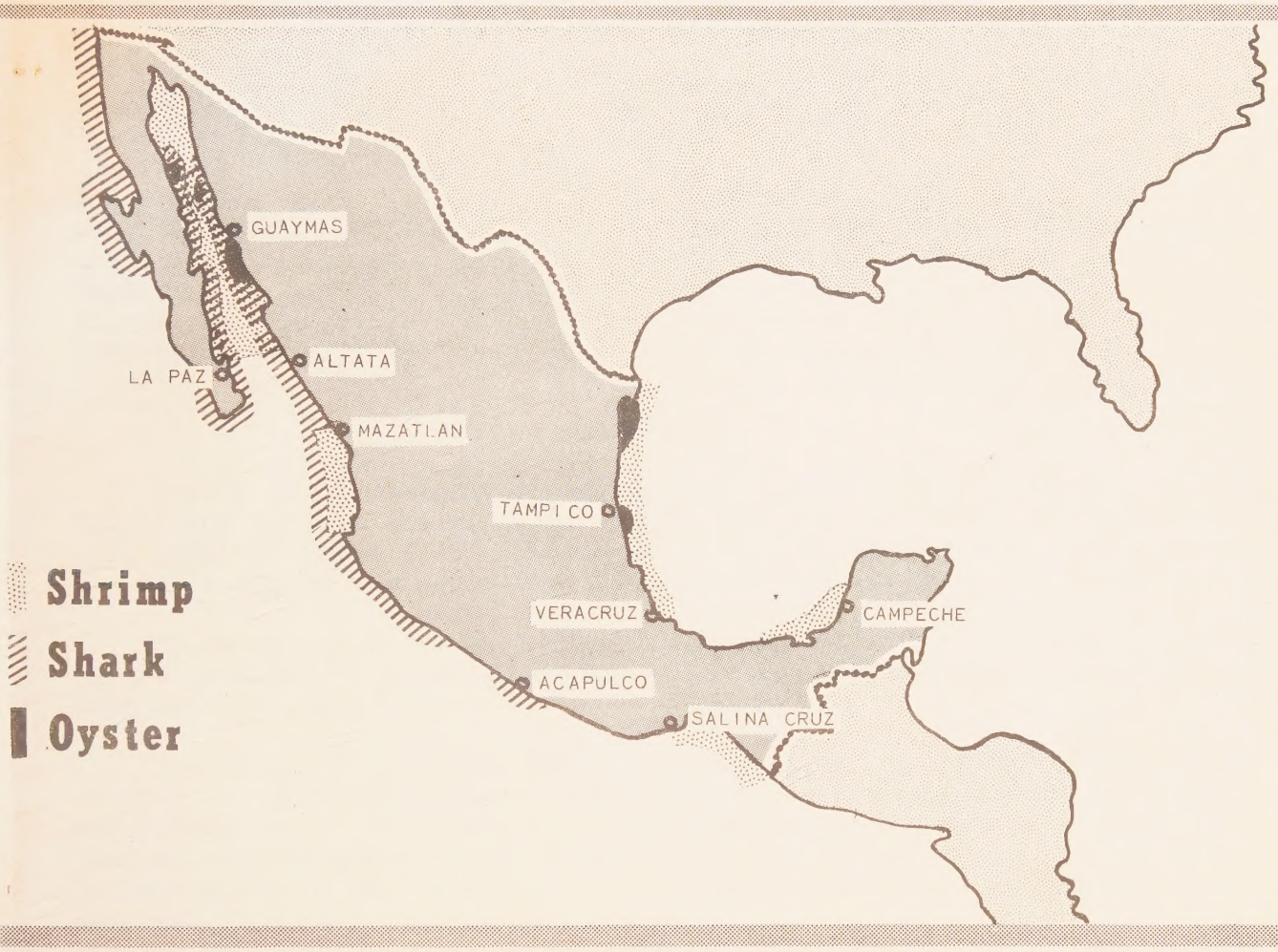

FISHERY LEAFLET 339

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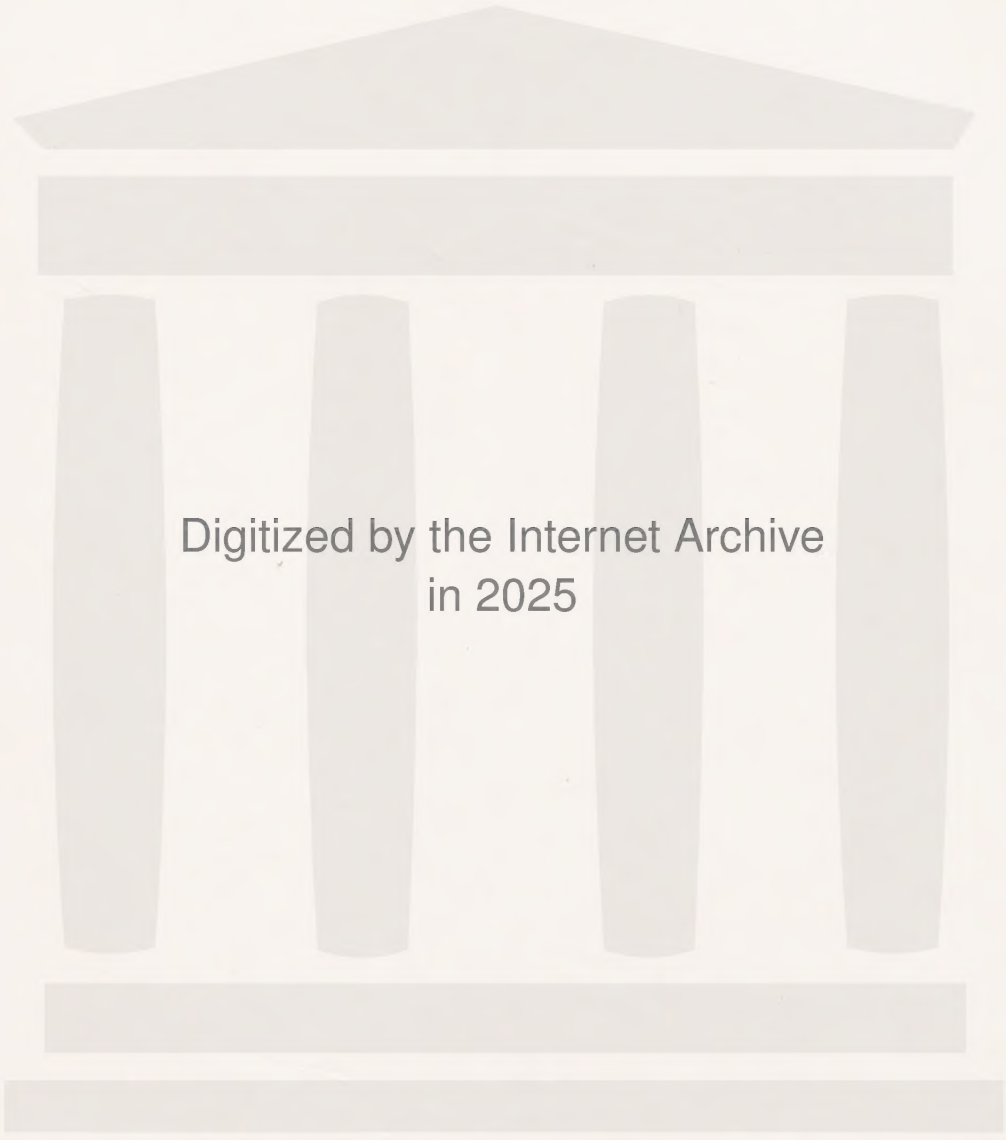
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United States Department of the Interior, J. A. Krug, Secretary
Fish and Wildlife Service, Albert M. Day, Director

Fishery Leaflet 339

Washington 25, D. C. March 1949

THE MEXICAN FISHERIES INDUSTRY[1/]

By Alan E. Hool, Economic Assistant

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INTRODUCTION

Mexico is something of a phenomenon in that a country situated in semi-tropic and tropical latitudes with about 5,600 miles of sea coast bordering such prolific marine life areas as the Pacific Ocean, the Gulf of Mexico, and the Caribbean Sea, is nevertheless relatively poor in exploited fisheries.

The development of the Mexican fisheries industry is of necessity limited by the numbers of fish available and the extent to which the markets for those fish have been developed.

The extent to which any one fishery may expand is limited by the numbers of fish the water can produce. The productivity of fishing areas is in direct proportion to the amount of food available in those waters. It appears that extensive regions about the Mexican coasts do not produce food in quantities comparable to regions of the world where commercial fish species are abundant.

It appears that the richest waters about Mexico are those around Lower California and that even these waters, because of the scarcity of basic food, cannot be compared in abundance of marine life with the great fish producing areas of the world.

Fishery products as a rule have two markets, the local and the foreign. In Mexico over two-thirds of the edible fishery products taken along the Mexican coasts are taken either by foreign boats or for export and thus are

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1/ American Embassy Report No. 780, Mexico, D.F., December 31, 1948.

dependent upon the whims of a foreign market. Tuna and shrimp, Mexico's two largest fisheries, depend almost entirely on export, and almost all the export fisheries can be classed as luxury. These luxury fisheries are for the most part now being exploited to a maximum degree with little likelihood of other luxury fisheries being developed.

The domestic market is not yet highly developed and it is apparent that the relatively inexpensive fish which are available in considerable numbers in Mexican waters are not being utilized to supply the domestic market in a degree comparable to their abundance. The result of this situation is that fish which should be inexpensive actually command luxury prices.

Perhaps one of the reasons for the slow development of the domestic market is that the Mexican people have been primarily an inland people not given to extensive maritime activities and therefore have never regarded fish as a staple part of their diet.

FISHING PORTS

The principal ports of the Mexican fisheries industry, beginning on the North Pacific coast are as follows:

Ensenada, Lower California. This is the base for the fishing of California sardine, Pacific mackerel, and tuna. There is also considerable diving for abalone and seaweed. There are three canneries located at Ensenada and one seaweed extracting plant for the production of agar agar.

There is a small cannery located on Cedros Island off the coast of Lower California and another at Cape Saint Lucas at the tip of the peninsula, and some fishing is done out of Santa Rosalia, La Pax, and San Jose del Cabo. With the exception of Ensenada, however, there are no fishing ports of any importance in Lower California.

Guaymas, located on the coast of the State of Sonora about half way up the Gulf of California, is one of the most important fishing ports in the Republic. This is a major shrimp producing region and there are six freezing plants in Guaymas which process large quantities of shrimp which are exported almost totally to the United States. Roughly 80 percent of the catch coming into Guaymas is shrimp. Totoaba is also frozen in considerable quantities, while there are two small canneries which put up Spanish mackerel, shrimp, and some oysters. Guaymas is also an important shark liver collection center. There is one plant semi-processing the livers but the bulk are shipped frozen directly to the United States.

Topolobampo, located on the coast of the State of Sinaloa roughly halfway between Guaymas and Mazatlan, is another shrimp port with one freezing plant handling the almost exclusively shrimp take.

There are also small canneries located at Los Mochis and La Cruz, Sinaloa, and freezing plants at La Reforma and Eldorado, Sinaloa.

Mazatlan, Sinaloa, is the largest port of the State and fisheries represent one of the port's major activities. There are three freezing plants and the fish take off the Mazatlan area is estimated to be 94 percent shrimp, 4 percent mullet and 2 percent miscellaneous. A certain amount of shark fishing is also carried on from Mazatlan.

Escuinapa, Sinaloa, is a fishing port of considerable consequence with three small canneries, principally putting up shrimp and Spanish mackerel with a number of miscellaneous fish combined and canned in a manner similar to salmon.

Manzanillo, Colima, is principally a shark liver collection center. Shark livers collected in this area are shipped to Guadalajara for processing. A certain amount of fresh fishing is done in Mantanillo to supply the markets of Colima and Guadalajara.

There are no other commercial fish ports of importance on the Pacific coast. Acapulco, a seaport of considerable fame, is primarily a game fish port and no commercial fishing except some shark is undertaken. There is some primitive commercial fishing along the coasts and in the lagoons of Oaxaca and Chiapas. This catch is principally shipped to nearby inland markets.

Tampico, Tamaulipas, is a port on the Gulf of Mexico where fishing is undertaken on a substantial scale. Fish taken both up and down the coast for a good distance usually enter through Tampico. The principal species taken, in about the same percentage, are shrimp, oysters, red snapper, Gulf pike, and mullet. There is one small canning plant at Soto la Marina, Tamaulipas, north of Tampico. This plant cans fish from the lagoon district of northern Tamaulipas.

Tuxpam, Veracruz, and the surrounding laguna district provide fresh fish, the two outstanding species being mojarra and mullet.

Veracruz, Veracruz, is Mexico's major seaport and also figures as the principal port for fresh fish destined for the Mexico City market. Snapper, Gulf pike (robalo), Spanish mackerel, shrimp, and other miscellaneous fish are taken. There are two small canneries and two small freezing plants located at Veracruz.

Alvarado, Veracruz, provides considerable fresh fish, Gulf pike being the principal species fished.

Coatzocoalcos, Veracruz, boasts a moderate take of Gulf pike, which is shipped fresh or dried to the country's consumption centers.

Ciudad del Carmen, Campeche, has recently become a very important shrimp fishing port. The take of shrimp off the Campeche banks and in the Carmen lagoon has been of sufficient size to have two freezing boats stationed in the area, while at Ciudad del Carmen several freezing plants are in the process of construction.

LOCATION OF FISHERIES

The Pacific Coast of Mexico provides about 76 percent of the total fish take in Mexican waters, compared with only 21 percent for the Gulf Coast. The principal west coast fishery is that for tunas, which are particularly prevalent in the high seas area surrounding the peninsula of Lower California. This fishery, however, cannot be considered Mexican, since no appreciable amounts are taken by Mexican fishermen. Vessels of California registery from the ports of San Diego and San Pedro, California, account for almost the entire take. Barracuda, yellowtail, and Jackfish inhabit much the same waters as the tuna and are likewise taken almost entirely by United States fishermen.

Mexico is at present attempting to expand its tuna industry from ports on the Gulf of California. The extent of the success of this enterprise will depend on the equipment used, the continued abundance of tuna, and the degree to which Mexico can develop its local and foreign markets.

The next most important fishery in Mexican waters and the most important from the Mexican industry standpoint is that for shrimp. The Pacific area at present most heavily fished is in the Gulf of California between San Felipe, Baja California, and Altata, Sinaloa. This section represents the principal shrimp fishery of the Republic. Other shrimp grounds not now being heavily fished lie between Mazatlan and Cape Corrientes and between Salina Cruz and the Guatemalan border.

On the Gulf of Mexico the heaviest concentration of shrimp is found in the Campeche-Tabasco area. The shrimp catch in this region is large, while there is more limited shrimp fishing along the coast of Veracruz and Tamaulipas in the Gulf of Mexico. Indications are that both the shrimp fishery in the Gulf of California and that off the coast of Tabasco and western Campeche have already reached their maximum productivity and that the future production in these areas will depend upon the variation in the annual productivity of the shrimp. There are no other known areas along the Mexican coast that even approach the potentiality for shrimp production of the Gulf of California and the Campeche areas.

The next largest fishery in Mexico is that for shark. This is almost exclusively a West Coast industry. Shark are taken primarily for their livers which are rich in Vitamin A and the West Coast sharks, as a rule, have livers of higher vitamin potency than do those in the waters of the Gulf of Mexico or the Caribbean Sea. The principal shark catch is on the west coast of Lower California in the Gulf of California and the Manzanillo areas, with a small take registered in the Zihuatanejo-Acapulco area.

The future of the shark fishery is not encouraging and there are already indications that the sharks can readily be depleted. Also the expected commercial production of synthetic Vitamin A in the near future can only hasten the decline of the shark fishery.

The California sardine, another important Mexican fishery, is limited to the waters along the west coast of Lower California. This is a fishery

that could be much more important to Mexico than it is now, as the abundance of the sardines indicates the possibility of a larger catch.

Inhabiting almost the same waters as the California sardine, the Pacific mackerel also seems to be more abundant than indicated by present production. Also like the sardine, it is basically an inexpensive fish. That these species are not luxury fish is probably the reason that these fisheries are not being fully utilized.

The totoaba fishery located in the waters of the Gulf of California is of some importance but is definitely limited in annual production and may even be undergoing depletion.

The Gulf pike (robalo) are another relatively important group of fishes which occur in the estuaries and river systems on both coasts of Mexico but are most heavily fished on the coast of the Gulf of Mexico. The pike is not in demand as an export item, its only importance being that for local consumption. This explains why the Pacific robalos are almost untouched while those of the Gulf of Mexico, near local consumption markets, are taken on a considerable scale. It is believed that the pike fisheries can be substantially increased should domestic demand become greater.

The snappers (guachinangos and pargos) are like the pike in that they are present both in the Pacific and the Gulf of Mexico. Like the pike they are also more heavily fished on the Gulf of Mexico and are mostly for domestic consumption. However, the snappers do have a limited export demand.

Several species of abalone occur along the west coast of Lower California and are restricted to a narrow littoral belt, most of which is now being fished. The possibility of a greatly increased catch or the discovery of new abalone fishing grounds seems remote.

There are several species of spiny lobster found on both coasts of Mexico. Commercial fishing of the spiny lobster only occurs along the Pacific coast of Lower California. Areas which are not now fished but may in the future come into production are along the Gulf of California side of the peninsula of Lower California.

The mullets are a fish that appear to be abundant in the estuaries, lagoons, and brackish water systems of both coasts of Mexico and nowhere, except in the lagoons of Chiapas, are they exploited near capacity. The mullet is an inexpensive fish suitable for local consumption and yet is not utilized in anything like the degree possible.

The Spanish mackerel, an inexpensive fish ideally suitable for domestic consumption, is prevalent along both coasts of Mexico and yet is not taken in proportion to its abundance.

Oysters and other mollusks are commercially fished along both coasts of the Republic. Principal areas are located in the Gulf of California and in

the lagoon areas between the States of Tamaulipas and Veracruz on the Gulf of Mexico. A limited catch of turtle and octopus is taken along the Gulf of Mexico and Caribbean coasts.

Another fishery of some importance is the sea trout (corvina) which is fished on both coasts with the principal catch taken in the Laguna Madre of the State of Tamaulipas. The sea trout, along with the mojarra, and sea bass (cabrilla), species of lesser commercial importance, inhabit both coasts of Mexico. These fish are mostly taken on the east or Gulf coast for the fresh fish domestic market, while a certain amount of canning of these species is carried on along the Pacific coast.

In addition there are numerous other fish species inhabiting the Mexican coasts, but none of them at present are of any commercial importance and do not appear likely to become important in the near future.

Inasmuch as many of the fishing grounds of Mexico are found in the lagoon areas of the Republic, a brief description of the more important lagoon regions is given.

The two most important lagoons on the Gulf coast with reference to fishery productivity are the Tamiahua Lagoon in the State of Veracruz and the Laguna Madre in the State of Tamaulipas. The former extends some 200 kilometers (125 miles) along the coast and has an average width of 16 kilometers (10 miles), while the latter is 110 kilometers (about 70 miles) long with a maximum width of 25 kilometers (15 miles). Both lagoons are separated from the sea by long sandy strips. There are many other smaller lagoons on the Gulf coast, located between these two and also south of the port of Veracruz along the coasts of the States of Veracruz, Tabasco, and Campeche. The Laguna de Terminos (also known as Laguna del Carmen) of Campeche is an extensive body of water having an oblong shape and rich in marine life. The other important lagoon systems in Mexico and which are being extensively fished lie along the coasts of Sonora and Sinaloa on the Pacific and Gulf of California and along the coasts of Chiapas and Oaxaca on the South Pacific.

These Mexican lagoon systems are considerable bodies of water, of varying degrees of salinity, according to the proportions of sea water and of fresh waters from rivers and creeks emptying therein. They are similar in being good fishery sources, but the majority are in regions having little land or sea transportation facilities.

The fresh water fisheries of Mexico account for about 3 percent of the total fisheries catch in Mexican waters. The main fresh-water fish are several species of whitefish, trout, and black bass. These species are principally caught in the lakes of Patzcuaro and Cuitzeo in the State of Michoacan. Carp and catfish are also caught in considerable quantities, mainly in Lake Chapala in the State of Jalisco. In the northern rivers of the Republic there is considerable river clam and oyster fishing, and cat and sucker fish are also taken to a limited degree.

An important consideration of the fresh-water fishery is its ability to supply fish to many rural areas where fish food would not otherwise be obtainable. Fresh-water fishing is carried on the year around, although June and July are the best months.

EMPLOYMENT

According to the most recent statistics available from the Mexican Fisheries Department (1947), there were 125 legally recognized fishing cooperatives in various parts of the Republic.

State or Territory	No. of Cooperatives
Lower California	21
Sonora	21
Sinaloa	19
Nayarit	4
Colima	1
Michoacan	2
Guerrero	2
Oaxaca	2
Chiapas	12
Chihuahua	1
Hidalgo	3
Mexico	1
Tlaxcala	1
Tamaulipas	7
Veracruz	19
Tabasco	3
Campeche	5
Yucatan	1
Total	125

There are 7,639 fishermen listed as members of these cooperatives and in addition it is estimated that there are fully 4,000 independent or free lance fishermen working commercially who are not members of any of the legally organized cooperatives. Of the cooperatives listed, 64 percent have a membership of less than 50 while 20 percent have a membership of between 50 and 100 and only 16 percent have over 100 members.

Over 60 percent of Mexico's local fish catch is obtained by these organized cooperatives, which are nothing more than groups of local fishermen banded together and registered with the Government, thus being eligible for certain tax exemptions and other privileges granted cooperatives. The free lance fishermen, accounting for the remaining percentage of the catch, often sell to and work through local cooperatives.

The number of fishermen working a district is not indicative of its productivity. As an example, there are over 4,500 fishermen working commercially in the Laguna Madre-Tampico-Tamiahua-Veracruz area, and yet this region produces only a fraction of the catch taken in the Gulf of California area covered by some 3,160 fishermen working out of Guaymas and Mazatlan. The reason for these disparities is the equipment used. The West Coast fishing grounds are organized for large-scale systematic fishing to a much greater degree than the Gulf Coast zone. Most West Coast fishermen in the California Gulf area have relatively well-equipped motor-driven boats while on the East Coast the majority of the fishermen work the lagoons in hand-propelled canoes and consequently the catch per fisherman is minimum.

Mexican fishermen can be divided broadly into two general groups, the free lance operators or independents, and the members of cooperatives.

Independent fishermen, the majority of whom operate with primitive equipment throughout the lagoon systems of the Republic, usually sell their catch to the local cooperative. These cooperatives advance the independent credit, but usually buy the catch at considerably less than market value. Independent fishermen using modern fishing methods are relatively scarce as few own the necessary equipment and in order to rent gear the fisherman is obliged to surrender a certain portion of his catch.

The earnings of the independent vary greatly in accordance with equipment, hours worked, and productivity of the region. On an average, it is estimated that the independent nets between 12.00 and 15.00 pesos[2/] per day.

The cooperatives form the largest group of fishermen and account for the greater part of the catch of the Mexican fishing industry. Cooperative fishermen work on a share basis and the cooperative handles the sale and division of the proceeds among the members according to the value delivered and the relative ownership of nets and boats. The average earnings of members are dependent on the species taken. For example, it is estimated that the average earnings of shrimp fishermen are 100.00 pesos per ton, which breaks down to between 800.00 and 1000.00 pesos monthly, or 26.00 to 34.00 pesos per day. Average earnings for other species are usually less than that for shrimp and on an overall basis amount to a net of about 18.00 pesos per day per fisherman.

Workmen employed in the fish canning plants are generally paid on a salary basis. The average wage ranges from about 7.00 pesos per day in the Gulf Coast canneries, where living costs are lower and labor plentiful, to between 8.00 and 10.00 pesos per day in the larger Pacific Coast plants. This wage usually includes the seventh day when not worked. If worked, double pay is given for the seventh day. The freezing plants, which primarily handle shrimp, for the most part pay wages on the basis of trays packed during an eight-hour shift. Average earnings under this system are 9.00 pesos per day.

Subsistence fishing in Mexican waters is known to exist on a considerable scale but there are no estimates available as to its extent. It is believed that all this fishing is done on a most primitive scale and the bulk of it centers around the lagoon districts of Tamaulipas, Veracruz, Tabasco, Campeche, and southeastern Oaxaca and Chiapas. A lesser amount of subsistence fishing takes place along the long stretch of Pacific coast and around the Yucatan peninsula.

The largest game fish catch in Mexican waters is taken around Coronado Island, off the northern coast of Lower California, by American sport fishermen

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2/ From 1941 until the devaluation of the peso on July 22, 1948, the peso was stabilized at 4.85 to $1.00. Since that time it has fluctuated around 6.80 pesos to $1.00 U.S. Cy.

operating out of United States ports in southern California, and Ensenada. This sport catch, which runs as high as 300,000 kilograms per annum, consists principally of Jackfish.

Guaymas on the coast of Sonora is the principal port of the Republic for sport fishing. Fishermen from the United States frequent Guaymas in great numbers during the winter season and it is considered that the Gulf of California area is one of the finest sport fishing grounds in the world because of the number of species inhabiting those waters. The total catch in the Gulf of California area is not known but is believed to run over 50,000 kilograms per year. There is also considerable sport fishing centered around the Acapulco area on the coast of the State of Guerrero, where the catch is believed to run from 5,000 to 10,000 kilograms per annum.

The Gulf coast ports of Tampico and Veracruz also have active sport fishing clubs and a moderate amount of sport fishing is undertaken in Gulf of Mexico waters. However, as a general rule the wealthier Mexican class who could go in for sport fishing is not maritime minded so probably the bulk of true sport fishing done in Mexican waters is by visitors from the United States.

FISHING VESSELS

According to official Government statistics the number of registered fishing vessels in 1946 was 5,698 and their total tonnage was 21,135.

United States vessels must register with the Mexican Government when fishing in Mexican waters and although these represent only a small part of total number, their importance in tonnage is considerable inasmuch as the tonnage per United States vessel is greatly superior to the average Mexican boat.

Not included in the above figures are hundreds of canoes which are used by fishermen, generally independents, to ply their trade in the lagoon, estuary, and river regions of the Republic.

Figures later than 1946 are not at present available but it is known that the tonnage figures have increased substantially due to the recent initiation of large scale fishing for shrimp along the Campeche banks.

For the purpose of facilitating breakdowns, in this and other sections of this report, Mexican waters are divided into five zones--two on the West Coast, two on the East Coast, and one of inland waters. The inland zone includes all rivers and lakes, while the other four zones include the coastline of the States and Territories shown below:

Pacific Ocean

Zone I	Zone II
Lower California (Territory)	Jalisco
Sonora	Colima
Sinaloa	Michoacan
Nayarit	Guerrero
	Oaxaca
	Chiapas

Atlantic Ocean

Zone III	Zone IV
Tamaulipas	Tabasco
Veracruz	Campeche
	Yucatan
	Quintana Roo (Territory)

Inland

Zone V
All rivers and lakes

The number of vessels and their respective tonnage registered for operations in the different fishing zones for the year 1946 were as follows:

Zone	Number of Vessels	Total Tonnage
I	2,209	13,397
II	661	1,141
III	1,778	4,748
IV	630	1,304
V	420	545
Total	5,698	21,135

There are no specific figures as to the type of motors employed in Mexican fishing vessels. However, 69 percent of all registered vessels are not equipped with mechanical motive power and must depend on hand power. Of the remaining 31 percent, practically all vessels weighing less than 10 tons are propelled by gasoline engines. The motive power of vessels in excess of 10 tons but not exceeding 50 tons is roughly divided between gasoline and diesel. Small diesel engines are popular for use in fishing vessels although their cost--approximately three times that for similar gasoline engines--limits their utilization to the medium and large vessels. It is estimated that all vessels in excess of 50 tons are powered by diesel engines.

It is obvious that existing Mexican fishing vessels and gear are inadequate to meet the normal demands of an expanding industry. The fact that 69 percent of the registered Mexican fishing vessels are not equipped with a motor and that almost all vessels of heavy tonnage are registered out of United States ports highlights the unsatisfactory position of the industry in regard to its ability to exploit Mexican waters effectively. Before the industry can show real development it is necessary that a large number of heavier boats be acquired. Due to the lack of adequate boat building facilities, it is probable that most of these boats would have to be supplied by imports.

FISHING METHODS EMPLOYED

Mexico has practically no offshore fishing fleet. The greater part of all offshore fishing done in Mexican waters is by United States boats. Mexican fish canning plants even contract United States boats to supply their needs for offshore species.

The Mexican fishing industry is dedicated almost entirely to coastal waters, estuary, and lagoon fishing. The average Mexican motor-driven vessel is not equipped for extensive sea voyages and fishermen seldom stay out over 36 hours.

There are two methods employed by United States fishermen in the capture of the various species of tuna in Mexican waters--hook-and-line and net. The hook-and-line fishery consists of bait boats and troll boats. In the net fishery the purse seine and the purse lampara are employed. Roughly, the total tuna catch may be divided as follows: 60 percent taken by bait boats; 30 percent by purse seine and purse lampara vessels; and 10 percent by troll boats.

The fishing methods employed in the taking of the other principal Mexican species are as follows:

Species	Method Employed
Shrimp	Otter trawl, weirs, and cast nets, in that order of importance.
Pacific mackerel and California sardine	Seines
Shark	Trot lines and gill nets
Spanish mackerel	Hook-and-line and beach seines
Snapper	Hand lines
Gulf pike	Hook-and-line and beach seines
Mullet	Beach seines
Mojarra	Beach seines
Sea trout	Hook-and-line and hawl seines
Sea bass	Hook-and-line and gill nets
Oysters	Hand diving--no apparatus
Seaweed	Hand diving--some apparatus
Abalone	Hand diving--some apparatus
Lobster	Trap
Fresh water fish	Seines, traps, hook-and-line, cast nets.

FISH TAKEN

The total catch in Mexican waters from 1940 through 1947 according to official Government figures was as follows:

Year	Quantity	Value
	Kilograms[3]	Pesos[4]
1940	70,518,843	34,434,116
1941	49,991,196	24,950,147
1942	52,440,567	40,703,256
1943	61,137,035	52,309,392
1944	74,517,116	70,064,381
1945	99,624,739	93,371,520
1946	112,451,742	108,952,517
1947	121,449,012	161,507,433

3/ One kilogram equals 2.2046 pounds.
4/ Peso value: 1940, $0.18546; from 1941 through 1947 the peso was stabilized at $0.206 U.S. Cy.

Official figures will invariably prove to be considerably less than the actual catch as there is no adequate overall source of information on quantities caught. Independent fishermen work without strict supervision or tally. Another cause of inaccuracy in official figures is the tendency for fishermen to report catches smaller than actually made in order to avoid taxes and other expenses incumbent to bulk catch.

A breakdown of the catch by species taken for 1946, the latest year for which this information is available, is as follows:

Species	Quantities	Value
	Kgs.	Pesos
Abalone	1,396,284	650,072
Albacore	2,842,891	5,464,984
Tuna	41,211,492	39,030,293
Barracuda	592,603	837,828
Skipjack	10,732,419	10,296,535
Sea bass	231,707	201,163
Mexican sea bass (totoaba)	1,553,655	1,719,660
Shrimp (fresh)	8,851,461	10,749,487
Shrimp (dry with shell)	1,579,352	3,492,808
Shrimp (dry without shell)	22,010	114,109
Sea trout	1,703,261	1,330,008
Snapper	1,195,835	3,032,904
Yellow-tail and Jackfish	1,719,419	1,392,277
Spiny lobster	859,986	2,164,518
Mullet	803,665	634,260
Pacific Mackerel	1,813,509	249,454
Jewfish	615,180	635,596
Mojarra	1,332,915	1,180,483
Oysters (with shell)	3,760,388	2,229,965
Oysters (without shell)	199,246	365,240
Gulf pike	1,976,733	4,325,579
Gulf pike (dried or salted)	1,379,824	3,021,782
Sardine	12,553,939	1,206,717
Spanish mackerel	868,642	1,529,106
Shark	1,268,274	1,219,630
Shark (dried or salted)	698,731	789,630
Shark fin	91,856	447,703
Turtle	210,393	179,615
All other species	10,363,689	10,461,111
Total	112,451,742	108,952,517

Reference is made to the zoning of the principal fishery areas of the Republic, outlined previously under the heading "Fishing Vessels."

Zone I accounts for the bulk of fish caught in Mexican waters and it is in this region that fishermen operating out of United States ports take a large annual catch.

The following table shows the present estimated importance of each zone with respect to the total volume taken in Mexican waters. With the exception of

Zone IV, the overall importance of each zone has varied little during the last several years. However, Zone IV has approximately doubled in productivity since 1944, due to the development of the shrimp fishery and to the general increased activity off the Campeche banks.

Zone	Percentage of Total
I	72
II	4
III	17
IV	4
V	3

PRODUCTION AND METHODS OF PROCESSING

There are no official records kept of the production of canned fish food in Mexico. The only manner in which these data might possibly be obtained is through personal contact with each and every canning or freezing plant and it is doubtful if even by this approach accurate figures could be obtained.

The largest national pack is frozen shrimp. Reliable estimates place total frozen shrimp production between 10 and 12 million pounds per annum. This pack is almost totally exported to the United States, usually in five pound cartons.

There is very little production of frozen fillets in Mexico. Some species, such as Gulf pike and sea bass, are frozen in fillet form on a limited scale by several freezing plants located in Guaymas and Mazatlan. Some of this production is exported but the greater part is sent to Mexico City and other centers of domestic consumption.

The products canned by the nation's fish food concerns are, in the order of their importance, as follows: California sardine, Pacific mackerel, abalone, tuna, Spanish mackerel, shrimp, oysters, and mullet. A variety of other species are packed to a lesser degree and under fancy sounding names, but their importance in the total pack is minimum.

The California sardine is packed in No. 2 cans and in oval one-pound cans and is put up both in tomato sauce and brine. The Pacific mackerel and abalone are packed in brine. Canned tuna has a little oil added, while most other products are packed in their natural form with the addition of a little salt.

The canning and freezing plants, small and large, represent an estimated total investment of ten million dollars.

The amount of fish pickled in Mexico is negligible.

Dry fish is a fairly important item in Mexico. Pike, mullet, shrimp, milk fish, and some snappers are the principal species dried. The production of dried fish is mostly effected in Veracruz, Tlacotalpan, Alvarado, and Coatzacoalcos, Veracruz.

The amount of smoked and kippered fish produced in Mexico is insignificant. A small amount of mackerel is smoked for sale to the delicatessen trade in the principal cities of the Republic.

PRODUCTION OF BY-PRODUCTS

The production of fish oil for the year 1946 was as follows, according to official Government statistics:

Type	Quantity	Value
	Kgs.	Pesos
Shark	76,826	900,669
Swordfish	11,314	11,394
Turtle	1,215	1,736
Mullet	200	120
Fish oil, not specified	2,985	4,237
Total	92,540	918,216

The insignificant amounts processed are generally only semi-refined, are of a poor quality, and there are no mills dedicated solely to fish oil processing. The domestic consumption of fish oil, with the possible exception of shark, is almost totally supplied by imports.

The production of fish meal and fish waste suitable for feed or fertilizer is limited in Mexico. Official figures indicate a 1946 production of animal and poultry feed amounting to only 49,076 kilograms with a value of 51,926 pesos. Fertilizer is processed on a small scale by the canneries around Ensenada. Output in 1946 amounted to 200,000 kilograms valued at 39,060 pesos.

Other by-products of the Mexican fishing industry are listed in the following table showing production and value for 1946:

Product	Quantity	Value
	Kgs.	Pesos
Marine algae (for agar agar)	309,900	349,900
Abalone shells	8,608	3,616
Tortoise shell	925	3,657
Snail shells	29,976	17,314
Oyster shells	9,000	90
Fresh water mussel shells	130,148	51,387
Shells, not specified	1,167	910
Sponge	480	11,780
Shark hides	24,052	50,403
Alligator skins	34,915	489,852
Miscellaneous fish skins	10,329	23,105
Shark liver	625,444	4,427,701
Mexican sea bass liver	30,841	397,677
Miscellaneous fish livers	2,593	14,869
Total	1,217,597	5,842,261

Shark livers, the most important single by-product of the Mexican fishing industry, are taken for their vitamin content. Shark fishing is carried on all

along the Pacific Coast with the principal liver collection points being Guaymas, Mazatlan, Manzanillo, and Zihuatenejo.

Livers taken at Guaymas are for the most part frozen and shipped to the United States in 5-gallon cans. There is one small concern in the city which semi-processes some livers for export to the United States. Shark livers taken at Mazatlan, Manzanillo, and Zihuatenejo are sold principally to Cia. Exportadora del Sur, S. A., of Guadalajara, Jalisco. This firm processes the livers for Vitamin A. The value of shark livers depends upon their vitamin content, which is determined by analysis, so that the value of a 17-kilogram can may vary from nothing to as much as 1,000 pesos. This company makes it a practice to return any can the value of which is less than 100.00 pesos. At full production, this firm processes 900 kilograms of livers daily. The value of the concentrated Vitamin A exported by this company to the United States during 1947 was $428,800 U. S. Cy.

Very poor use is made of fish waste in Mexico. At present it is estimated that canneries utilize only 40 to 50 percent of the catch, discarding heads, entrails, and fins which could be converted into fertilizer. For example, the largest Mexican catch is shrimp, yet the practice of Mexican shrimp fishermen is to head the shrimp on the fishing grounds and bring to shore only the headed shrimp, the inedible waste being thrown overboard even when the boat returns without a full load. Other species taken in the process of taking shrimp are thrown back. In addition, there are many tons of inedible species taken in seine fishing which are thrown back into the sea. These inedible varieties could be separated into classes, oily for making fish oils and non-oily for making fish meal.

The failure to develop the by-products industry is mainly due to the fact that the canneries and packing plants are not equipped with the necessary machinery and installations to process by-products.

INTERNATIONAL TRADE PATTERN

According to official Government statistics, the following were the total imports of fish food products since 1940:

Year	Quantity	Value
	Kgs.	Pesos
1940	812,890	1,299,433
1941	653,659	1,207,718
1942	328,605	613,252
1943	191,891	655,422
1944	683,036	2,975,397
1945	557,200	2,713,795
1946	1,604,679	7,950,075
1947	1,363,827	6,226,025
1948 (10 months)	837,732	3,967,657

The above figures represent a total of yearly imports under nineteen different fish and seafood classifications of the Mexican Import Tariff. Taking

1947 as the last complete year, it is found that three classifications, namely canned sardines, canned fish, not specified, and codfish accounted for 82 percent of the total value of imports.

The principal source during 1947 was Portugal, providing 54 percent of the total value of imports, which consisted almost entirely of sardines and general canned seafood. Norway was the second most important source, supplying 20 percent of the total value with shipments principally of codfish. The United States was the source for the most diversified line of fish food products, amounting to 18 percent of the total import value. The remaining small percentage imports were provided by a number of different countries.

In January, 1948, a tariff consolidation reduced to seven the number of classifications applicable to fish and seafood products. Present classifications and duties applicable thereto are listed below:

Fish, crustaceans, and mollusks, live, not specified.
Duty: 0.05 peso per gross or legal kilogram[5/] plus 10 percent ad valorem.

Fish or seafood, fresh or refrigerated, of any kind.
Duty: 0.10 peso per gross kilogram plus 10 percent ad valorem.

With the exception of tuna, which for the purposes of these calculations is not considered a Mexican fishery, only 4 of the 36 classifications for fish and seafood products listed in the Mexican Export Tariff in 1947 were of importance and accounted for 95.7 percent of the value of exports in that year. These four products are listed below:

Product	Export Value in 1947 (Pesos)
Fresh fish	39,324,897
Spiny lobsters (live)	1,412,951
Fresh raw shrimp	14,115,851
Canned abalone	6,540,253
Total	61,393,952

The only Mexican exports of fishery by-products of any importance are of fish livers and waste, the important item being shark livers. Exports from 1940 through 1947 are given below.

Year	Kilograms	Pesos
1940	106,038	55,056
1941	175,296	303,972
1942	658,055	2,181,480
1943	1,290,336	5,450,855
1944	1,263,855	6,503,077
1945	1,195,064	3,677,765
1946	615,832	2,050,230
1947	575,169	1,570,440

All of the above exports were made to the United States.

5/ Net kilogram is defined as the weight of the article without the weight of the container. Legal kilogram, used subsequently in this table, refers to the weight of the article plus the weight of its immediate container.

CONSUMPTION

The usual method of arriving at domestic consumption by adding imports to local production minus exports is of little value in the case of Mexico.

There is no way to derive from official statistics the actual consumption of fresh and prepared fish products by the Mexican nation, inasmuch as total figures for fish taken include fish taken by United States fishermen in Mexican waters as well as export luxury fisheries. Furthermore, there is no information available regarding the amount of the total catch utilized by domestic freezing, canning, and drying plants.

The following estimated figures on fresh fish consumption were obtained through a careful study of the catch of fresh fish species consumed domestically. A check on fish transported from coastal and inland fishery sources to the principal consumption centers was made, as well as an estimate as to consumption in the immediate coastal and fresh water fishing areas. Estimated production of processed and prepared fish destined for domestic consumption was combined with imports in order to obtain the figures for prepared seafood.

Product	Kilograms	Average per capita consumption
Fresh fish	9,849,750	0.95 pounds
Fresh shell fish	2,831,300	0.26 "
Prepared fish	2,611,650	0.24 "
Prepared shell fish	1,871,050	0.18 "
Total	17,163,750	1.63 "

It is estimated that fully 40 percent of Mexico's fish consumption is absorbed in the Federal District, with the other large cities and coastal population centers accounting for the bulk of the remainder. The Federal District is the largest Mexican fish consuming center because of its well developed communications and relatively higher standard-of-living. On the basis of absorbing 40 percent of consumption, or 6,865,500 kilograms, the per capita consumption of the Federal District is roughly 5.95 pounds.

The principal obstacle to general inland fish consumption is lack of transportation. For this reason the coastal fishing regions consume much more fish products than regions where fish requires transportation involving hundreds of miles. The only inland regions that consume fish to any degree are communication centers of the Central Plateau, such as Mexico City, Monterrey, Guadalajara, Puebla, and Oaxaca. Except for fish caught in streams and lakes, inland rural inhabitants seldom see fish.

An important local custom is the heavy consumption of dried codfish, obtained through imports, during the holiday seasons of Christmas, New Years, and

Easter. A local prejudice is that against eating fish, particularly shell fish, during those months which do not contain an "r", i.e., the summer months of May, June, July, and August. Even though Mexico is a predominantly Catholic country, there is a special dispensation allowing Mexican Catholics to eat meat on Fridays.

INTERNAL TRADE PATTERN

The marketing of Mexico's fishery catch is substantially as follows:

The independent or cooperative member sells his catch either to the boat owner or to one of the intermediaries to whom he is indebted.

One of the reasons for the existence of cooperatives is to handle the sales of the fish caught by its members and other independent fishermen. Ostensibly the cooperative sells the catch to consumption markets or to canneries and divides the proceeds among its members in accordance with the relative ownership of boats and nets.

Actually, however this is seldom practiced, as both independent and cooperative fishermen are usually in need of funds and in order to obtain cash advances find themselves under contract to intermediaries.

The four general types of intermediaries are: owners of boats and gear who rent such equipment for a certain portion of the catch; merchants who furnish other supplies to fishermen; distributors; fish wholesalers; and transportation agencies. Due to the lack of credit and efficient financial organizations, these intermediaries charge a much higher fee than would otherwise be the case, and the fishermen are naturally in a very poor bargaining position since they live from hand to mouth, have little money, and must sell their catch beforehand to whoever supplies them with the means to fish.

There are, generally speaking, two markets for the Mexican fishery catch, the United States and the domestic market, principally on the Central Plateau. Most of the catch in Pacific waters is either taken to the United States on the same boats on which the fish were caught, or landed at Guaymas and shipped by rail to the United States through the ports of Nogales or Mexicali. Pacific Coast fish products not exported are usually sold to the canning or packing concerns located at different points along the coast. A certain amount of fresh fish is shipped in ice from Mazatlan to Guadalajara by rail, with a smaller catch being shipped from Manzanillo to Guadalajara and Mexico City. The lagoon catch of southeastern Oaxaca and Chiapas is shipped to markets in the city of Oaxaca by truck or rail.

The canned fish products from Lower California destined for consumption in the interior of Mexico are transported by water to Mazatlan or Manzanillo and thence by rail to Mexico City and other centers.

The Gulf Coast catch, a greater percentage of which is consumed within Mexico, is delivered to the interior by two routes of transportation, refrigerated truck and rail. Fish taken at Tampico and in the Tamiahua region

are now almost all transported to Mexico City in refrigerated truck, the rail route being longer and slower with greater danger of spoilage.

The largest movement of fresh fish is from Veracruz to Mexico City and the transportation facilities are relatively fast with both rail and highway being used. Fish from Alvarado, Tlacotalpan and Coatzacoalcos are shipped fresh or salted by rail to Mexico City and other points.

Wholesale fish houses in Mexico City handle the catch of certain regions or cooperatives, delivering the fresh fish to retail outlets, hotels, and restaurants.

Inasmuch as the fish catch is seasonal, the price on the retail market varies considerably throughout the year.

There are no special taxes on wholesale or retail marketing of fish products and as far as can be ascertained there are no price or marketing agreements.

The Mexican Government made an effort to help fishermen through the organization of fishing cooperatives, which were intended to provide not only collective bargaining but a general betterment of working conditions. Numerous decrees have been issued for the protection of cooperatives and two affecting the production and marketing of fish are as follows:

(1) To conduct commercial fishing for abalone, shrimp, squid, lobster, mullet, oyster, octopus, Gulf pike, and Mexican sea bass (totoaba) in general and for sea bass (cabrilla) and sea trout in the Gulf of California north of the 27th parallel, a contract-concession is required. These concessions are granted only to fishermen's cooperative societies duly authorized and registered in accordance with the cooperative laws.

(2) A subsidy amounting to 100 percent of the amount of the production tax of 1.00 peso per kilogram is made to fishing cooperatives on the following fishery products: abalone, clam, sea bass (cabrilla), squid, sea trout, lobster, crawfish, oysters, octopus, and Mexican sea bass (totoaba).

There has been in recent years a marked increase in the number of freezing plants and an overall improvement in freezing procedure. There has also been considerable advance in the types of boats and technique used in the shrimp fishery. Other fisheries have shown little advance in technology, organization, and financing since prior to the war and for the most part fisheries, other than shrimp, California sardine, Pacific mackerel and abalone, are being worked under relatively primitive conditions.

Although some research has been made on fresh water fish, there has been no such activity in the case of Mexico's important marine fisheries, with the possible exception of shrimp. As a result of this lack of investigation the fishing industry is often conducted wastefully and many regions which formerly abounded in valuable fish species have been fished out. As a rule, Mexican fishermen have had no education or training in fish conservation and as a result the industry probably wastes as much as it produces, with the corresponding depletion of valuable resources.

OUTLOOK SUMMARY

The Mexican fisheries industry is exploiting only its luxury export fisheries on a near capacity basis. Non-luxury or inexpensive fish are not being caught in any degree comparable to their abundance. Inasmuch as a sound fisheries industry is primarily based on the exploitation of the inexpensive fish populations, it is obvious that Mexico must solve this problem in order to realize its full possibilities as a fish producing nation.

The future for Mexican luxury fisheries, such as shrimp, is promising and appears to be growing substantially through more modern methods of exploitation. However, it is doubtful if the present apathetic attitude toward the development of domestically consumed fisheries will change in the forseeable future.

The following factors are directly responsible for the present inability of Mexico properly to exploit its non-luxury fishery resources with the consequent extremely low per capita consumption:

(1) Lack of adequate fishing boats and gear.

(2) Fishermen need training and education.

(3) There are no liberal credit facilities for fishermen.

(4) Adequate refrigeration facilities are lacking at points of debarkation of catch.

(5) Principal consumption centers need cold storage facilities in order to avoid seasonal fluctuations in supply.

(6) Many fishing areas are now isolated for lack of rapid low cost transportation.

(7) Scientific investigation is required to increase present fisheries and open others.

(8) Rigid control of fishery resources is needed for the preservation of productivity.

The import requirements of Mexico have been declining since 1946 and it is probable that the record imports of over 1.5 million dollars registered for that year will not be repeated in the near future because of the present dollar shortage being experienced by Mexico. It is believed that imports in the future will be limited to the staple consumption items such as codfish and sardines.

As has been apparent in the discussion of Mexican exports, almost all luxury fisheries are exported in their entirety and thus at least 95 percent of the production of shrimp, abalone, and lobster may be considered exportable surplus. By proper exploitation it is possible that large exportable surpluses

of such fish as snapper, Gulf pike, Mexican sea bass, Pacific mackerel, and California sardine could be obtained but this is speculation which only the future can confirm.

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